INSTRUCTION BOOK
FOR
MOTOR-GENERATOR
PU-235/U

PROCESSED FOR EXPORT
MFR. DESCRIPTION QUAN.
700 262PU235U BOOK 1A 6-56 1
PART NO. SEC-DATE
Army-Denn. Mfg. Co., Fram., Mass. C. G. D. ENG. SECT., COLUMBUS, OHIO

BOOK NO. 1B235-2

KURZ & ROOT COMPANY

APPLETON, WISCONSIN

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SAFETY NOTICE

This equipment generates voltages that are dangerous to life. Do not attempt to make adjustments or change connections while the equipment is in operation. Severe, and possibly fatal, shocks may result from contact with live parts. Keep tools, oilcans, parts, and miscellaneous objects away from the generator. Keep moisture away from the equipment and keep the surrounding area dry.

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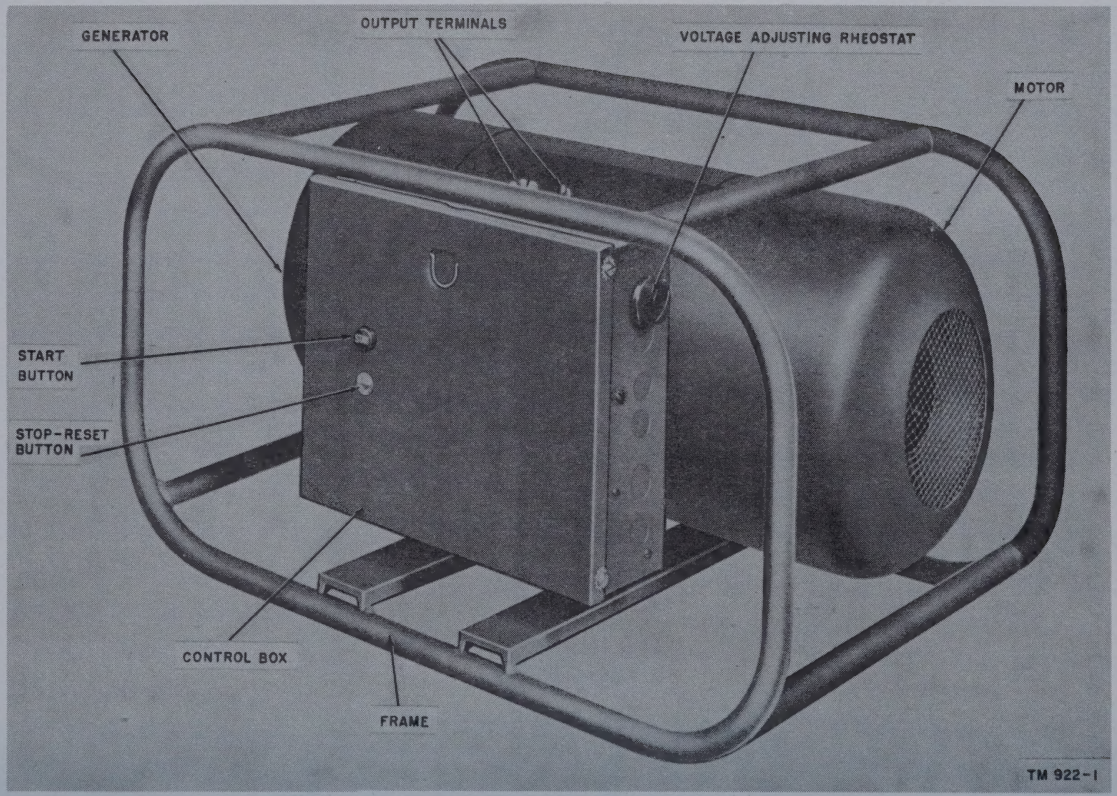

Figure 1. Motor-Generator PU-235/U.

Note. This instruction book will be replaced by TM 11-922, which, when printed, will be listed in SR 310-20-4.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

These instructions are published for the information and guidance of all concerned. They contain information on the operation and on the organizational and field maintenance of the equipment as well as a discussion of the theory of operation. The instructions apply only to Motor-Generator PU-235/U.

2. Forms and Records

a. The following forms will be used for reporting unsatisfactory conditions of Army equipment.

(1) DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), Navy Shipping Guide, Article 1850-4 (Navy), and AFR 71-4 (Air Force).

(2) DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

(3) AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

(4) DA Form 11-260, Operator First Echelon Maintenance Check List for Signal Corps Equipment, Power Units, Reel Units. This form will be used in accordance with the instructions appearing on the back of the form.

(5) DA Form 11-261, Second and Third Echelon Maintenance Check List for Signal Corps Equipment, Power Units, Reel Units. This form will be used in accordance with the instructions appearing on the back of the form.

b. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. General Description

(fig. 1)

Motor-Generator PU-235/U consists of a 3 horsepower (hp), 115-volt alternating current (ac), 50-60 cycle motor driving a 28.5-volt direct current (dc) generator. The unit is designed to supply 1,500 watts of dc when operated at a speed of 3,500 revolutions per minute (rpm). A control box, mounted on the front of the unit, contains the controls and accessories necessary for the proper operation of the unit. The motor rotor, the generator armature, and the cooling fan are mounted on a common shaft. The motor stator and the generator field assembly are mounted in a common housing. The entire unit is mounted within a tubular steel frame.

Note. For the purpose of locating various parts and components of the unit, the control box will be considered as the front. The right and left sides will be determined by facing the control box.

4. Purpose and Use

Motor-Generator PU-235/U is used to supply power to Radio Set AN/GRC-19 in classrooms and schools. It is not intended to be used under combat conditions.

5. Major Parts and Assemblies

(fig. 1)

a. Motor. The motor is of the two-pole, single-phase, capacitor-start, induction type. When operated on 115-volt, 60 cycle, ac, it is rated 3 hp at 3,500 rpm. When operated on 115-volt 50 cycle ac, it is rated 2.5 hp at 2,900 rpm.

b. Generator. The generator is of the two-pole, one-interpole, self-excited, compound-wound type. It is inherently regulated and will supply 1,500 watts of dc when operated at 3,500 rpm.

c. Control Box. The control box is mounted on the front of the unit and contains the following parts: The motor starting capacitors, the voltage adjusting rheostat, the output terminals, the motor starter, the motor starting relay, the suppression capacitors, and the ac input terminal block.

d. Frame. The frame in which the unit is mounted is constructed of welded tubular steel. It is designed to act as a base for the unit and to protect it from damage. It also acts as a skid when the unit is to be moved.

6. Performance Characteristics

a. Operation, 60-cycle.

Approx Load	Amperes	Volts	Watts	Rpm
1/4	13.25	28.5	375	3,570
1/2	26.50	28.5	750	3,550
3/4	39.75	28.5	1125	3,530
4/4	53.00	28.5	1500	3,500
5/4	66.00	28.5	1875	3,450

b. Operation, 50-cycle.

Approx Load	Amperes	Volts	Watts	Rpm
1/4	11.00	28.5	315	2,980
1/2	22.00	28.5	630	2,965
3/4	33.00	28.5	945	2,950
4/4	44.00	28.5	1250	2,940
5/4	55.00	28.5	1565	2,910

7. Condensed Specifications

a. Motor.

Make.....Kurz & Root Company.
Model No.....E1056M778.
Phase.....Single.
Type.....Capacitor-start, induction run.
Voltage.....115.
Cycles.....50-60.
Amperage.....30.
Power factor.....80%.
Speed (rated load).....3,500 rpm at 60-cycle operation.
2,900 rpm at 50-cycle operation.
Temperature rise.....50° C.
Duty cycle.....2 hours.
Bearings.....Sealed ball bearing.

b. Generator.

Make.....Kurz & Root Company.
Model No.....E1055M778.
Type.....Self-excited, compound-wound.
Voltage.....28.5 dc.
Amperage.....52.6 at 60-cycle operation.
44 at 50-cycle operaton.
Rating.....1,500 watts at 60-cycle operation.
1,250 watts at 50-cycle operation.
Speed (full load).....3,500 rpm at 60-cycle operation.
2,900 rpm at 50-cycle operation.
Temperature rise.....50° C.
Duty cycle.....2 hours.
Bearings.....Sealed ball bearing.

c. Control Box. The following components are contained in the control box.

1	Motor starter 3 hp, 115-volt, 1-phase,
1	Voltage relay, 135-volt pick-up.
1	Capacitor, feedthrough.
2	Capacitors, motor starting.
2	Capacitors, bypass.
1	Rheostat.
2	Terminal studs.
1	Terminal block.

8. Tabular Data

Quantity	Item	Dimensions				
		Width (in.)	Length (in.)	Height (in.)	Volume (cu ft)	Weight (lb)
1	Motor-Generator PU-235/U, consisting of:	18-1/4	27-1/2	14-5/8	4.4	214
1	Motor-Generator Unit	11	26	12	2	173
1	Control Box	4	12	10	.28	19-3/4

CHAPTER 2

INSTALLATION

9. Siting

When locating the PU-235/U, proceed as follows:

a. Locate the unit as near as possible to the electrical load and the power source. This will hold the voltage drop in the leads to a minimum.

b. Check the location for free air circulation. An unobstructed air space of at least 1 foot on all sides of the motor generator is preferred.

c. Check the location for gas fumes, chemical fumes, moisture, and dust. The above factors will shorten the life of the unit. If conditions are such that the above factors cannot be avoided, make every effort to have free circulation of air.

d. Avoid sites that are exposed to the direct rays of the sun. The radiated heat will reduce the life of the unit. This is especially true in the case of the motor starting capacitors.

10. Preparation of Foundation

No special foundation is required for the unit. Any site or location that permits the unit to rest firmly and reasonably level is suitable. If the unit must be located where mud, snow, or wet grounds are present, use planks, boards, or the base of the shipping crate to make a platform.

11. Uncrating, Unpacking, and Checking

a. Uncrating and Unpacking. When packed for export shipment, Motor-Generator PU-235/U is protected by a moisture-vaporproof barrier and a waterproof shroud within the crate. Do not uncrate the unit until it is needed, and avoid damage to the moisture-vaporproof barrier before uncrating. When packaged for domestic shipment, the moisture-vaporproof barrier and the waterproof shroud are not used. To unpack the unit, proceed as follows:

(1) Be sure the unit is right side up.
(2) Cut and remove the iron straps from the crate.
(3) Remove the nails that hold the cover and the two sides of the crate.
(4) Pull out the nails that hold the crate ends to the base.
(5) Open the outer waterproof paper covering and unpack the instruction manuals that are on top of the waterproof cover. The packaging within the crate is secured under the unit and cannot be completely removed until the following operations are complete.

(6) Open the moisture-vaporproof barrier.
(7) Open the inner corrugated paper wrapping.
(8) Remove the bolts that secure the unit to the base of the crate.
(9) Lift the unit from the crate.

b. Checking. Check to see that two copies of this manual are included in the crate. If any damage is noted, or the equipment does not check with the packing list, fill out and forward DD Form 6 in accordance with the instructions given in paragraph 2a(1).

12. Setting up Equipment

After a suitable site (par 9.) has been located and the foundation (par. 10) prepared, set up the unit as follows:

a. Place the unit on the foundation in the desired operating position. Check the unit for solid seating by attempting to rock the frame.

b. Remove the cover from the generator end of the unit. (This is the end to the left of the operator when the operator is facing the control box.)

c. Check the armature for free rotation by turning it with the hand. While the armature is rotating, listen for any noise that indicates rubbing of parts other than the brushes.

d. Check the brushes for proper seating on the commutator.

e. Check all vent openings for obstructions.

f. Press the STOP-RESET button on the control box (fig. 1).

g. Check the voltage, phase, and frequency of the power supply for conformance with the name plate data.

h. Open the door of the control box and remove one of the knock-out plugs.

i. Be sure the source of power has been turned off or disconnected. Guide the ac leads through the opening where the knock-out plug was removed and connect the leads to the two bottom terminals of the terminal block.

j. Connect the power supply to the unit.

k. Start the unit and shut it off immediately. While the unit is coasting to a stop, listen for any unusual noise or vibration.

l. After the previous steps have been checked and all are found satis-- factory, the load leads may be connected to the output terminals (fig. 1).

m. Start the unit by pushing the START button on the control box (fig. 1). Adjust the output voltage to the desired value. Place the load on the generator and observe the commutation of the brushes. Under the worst possible conditions, fine pin point sparks may be present. This is acceptable.

n. Replace the generator cover.

13. Removal of Corrosion Preventives

All corrosion preventives used on this unit are of a permanent nature. It is not necessary to remove them to operate the unit.

14. Connections and Interconnections

All internal electrical connections for the proper operation of the unit are made at the factory. The power supply and load connections are to be made as instructed in paragraph 12g through j.

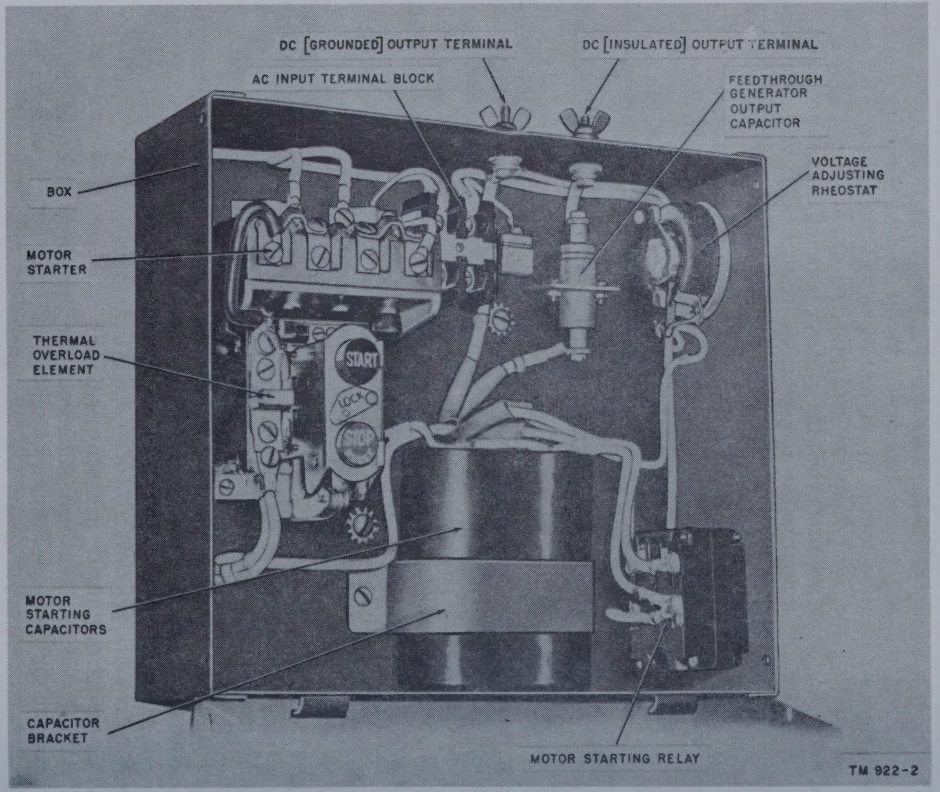

Figure 2. Control box, cover open.

CHAPTER 3

OPERATION

Section I. CONTROLS AND INSTRUMENTS

Note. This section describes, illustrates, locates, and furnishes the operating personnel with information pertaining to the various controls and instruments provided for the proper operation of this equipment.

15. Controls

(fig. 2)

a. Motor. The motor of the PU-235/U is furnished wth a push button, across the line type of motor starter. This starter is located in the control box and is used to start or stop the unit in such a manner that neither the operator nor the equipment will be exposed to danger. Pressing the START button will place the unit in operation. Pressing the STOP-RESET button will stop the unit. A thermal overload element connected in the STOP-RESET button circuit provides protection against dangerous overloads.

b. Generator. The generator of the PU-235/U is furnished with a voltage adjusting rheostat. This rheostat is located in the control box and is used to control the output voltage of the generator. Turning the rheostat knob clockwise will raise the voltage, turning it counterclockwise will lower the voltage.

16. Automatic Controls

(fig. 2)

The PU-235/U is provided with two automatic controls. A thermal unit connected in the STOP-RESET button circuit will open the power supply circuit and stop the unit automatically when dangerous overloads exist. A motor starting relay, connected across the starting winding, will open and disconnect the winding when the motor has reached its operating speed.

Section II. OPERATION UNDER USUAL CONDITIONS

17. Preliminary Procedure

Check the equipment for tight connections, moisture, and oil or grease. If the operator is familiar with the unit and it has been operated recently, that is all that is necessary. If the unit has not been operated for some time or the operator is not familiar with the unit, follow the procedures of paragraph 12.

18. Starting

No special precautions are required in starting the unit. It may be started with the load on the generator if the type of load requires this. Press the START button to place the unit in operation.

19. Precautions After Starting

Immediately after starting the unit, check for any unusual noise or vibration. The unit, under normal operation, will have the noise and vibration of a large fan. After the unit has been operating for 5 or 10 minutes, check for high temperatures. It should be possible to place the bare hand on the unit at all times.

20. Applying Load

a. Place the load on the generator and immediately check for unusual noise or vibration.

b. Check the output voltage. Adjust it, if necessary, to 28.5 volts with the voltage adjusting rheostat.

21. Operating Procedure

With the exception of the output voltage adjustment, all the functions and adjustments of the unit are accomplished automatically. The output voltage may be raised by turning the voltage adjusting rheostat clockwise, and lowering by turning it counterclockwise.

22. Stopping

The power unit may be stopped by pressing the STOP-RESET button. No other operations are necessary.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. TOOLS AND TEST EQUIPMENT AND LUBRICATION

23. Tools and Test Equipment

There are no tools or test equipment furnished with Motor-Generator PU-235/U. However, in order to perform the necessary organizational maintenance, the following tools and test equipment must be available:

1 hammer
1 Multimeter TS-297
1 pliers, combination
1 screw driver, 4-inch blade
1 screw driver, 1-inch blade
1 wrench, open-end, 1/4 by 5/16 inch
1 wrench, open-end, 3/8 by 7/16 inch
1 wrench, open-end, 1/2 by 19/32 inch

24. Lubrication

Motor-Generator PU-235/U is equipped with two double-sealed ball bearings (fig. 10). These bearings are packed with lubricant and factory-sealed. No further lubrication is required. If the bearing becomes noisy, worn or otherwise defective, replace it.

Section II. PREVENTIVE MAINTENANCE

25. Definition of Preventive Maintenance

Preventive maintenance means making systematic checks and adjustments at regular intervals to keep the equipment operating at top efficiency. It is not the same as trouble shooting or repair. The purpose of trouble shooting and repair is to correct existing defects. Preventive maintenance is designed to prevent the development of defects. The importance of preventive maintenance cannot be overemphasized. Failure or inefficient operation of the power supply may cause the failure of the entire sytem of which it is a part. It is vitally important therefore that operators and repairmen maintain their equipment at peak performance.

26. Daily Maintenance Services

For the purpose of these instructions, a daily service period is considered to be 8 operating hours. Services are to be performed in accordance with DA Form 11-260 and in the specified sequence.

a. Inspect the unit for tampering and/or damage.

b. Inspect the unit for completeness and general condition.

c. Clean the exterior of the unit.

d. Check for normal operation and note any difficulty in starting.

e. Listen for any unusual noises or vibration.

f. Check for high temperatures.

g. Check for obstructions in the air vents and free circulation of air.

27. Weekly Maintenance Services

For the purpose of these instructions, a weekly service period is considered to be 64 operating hours. Perform the services according to DA Form 11-260 and in the sequence specified.

a. Perform all the daily maintenance services.

b. Inspect all cords, cables, and wiring for loose or dirty connections, cuts, frays, damaged insulation, and broken conductors.

c. Tighten all loose nuts, bolts, screws, and other fastenings.

d. Check the exterior of the unit for chipped paint, rust, and corrosion. Remove the rust or corrosion and touch up the damaged surfaces.

28. Monthly Maintenance Services

For the purpose of these instructions, a monthly service period is considered to be 256 operating hours. Perform the services according to DA Form 11-261 and in the sequence specified.

a. Perform all the daily and weekly maintenance services.

b. Remove the end cover plates and clean the interior of the equipment.

c. Inspect the condition of the commutator. Clean surface with a cloth moistened with carbon tetrachloride. If surface is slightly pitted, polish with fine sandpaper.

d. Inspect all wires, field coils, stators, and armature windings for damaged insulation and loose connections.

e. Remove the brushes from their holders and check them for wear. Replace them if worn to less than one half of their original length.

f. Inspect the brush holders and the brush springs for dirt. Check the springs for proper tension.

g. Inspect the armature for high mica. Remove accumulations of dirt from between the commutator bars.

h. Inspect the suppression components for condition and tightness.

i. Inspect the motor starter, voltage adjusting rheostat, and the motor starting relay for dirt, corrosion, and pitted contacts. Clean and remove pits if necessary.

j. Turn armature by hand and check alignment for rubbing parts.

29. Use of Preventive Maintenance Forms (fig. 3 and 4)

a. The decision as to which items on DA Forms 11-260 and 11-261 are applicable to the equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the back of the form.

b. Circled items in figures 3 and 4 are partially or totally applicable to Motor-Generator PU-235/U. References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

POWER UNITS, REEL UNITS *(Engine-Driven)*

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	COND.	NO.	ITEM	COND.
(1)	INSPECT FOR TAMPERING AND/OR DAMAGE. PARS. 11b, 26a		15	SPARK PLUGS - REMOVE AND INSPECT FOR CRACKED, CHIPPED, OR BURNED INSULATORS, EXCESSIVE DEPOSITS AND BURNED ELECTRODES.	
(2)	INSPECT FOR COMPLETENESS AND GENERAL CONDITION. INCLUDE TOOLS AND ACCESSORIES. PARS. 12, 26b		(16)	SUPPRESSION - INSPECT SUPPRESSION COMPONENTS FOR CONDITION AND GOOD CONTACT. PAR. 28h	
3	COOLING; LUBRICATING; AND FUEL SYSTEMS - INSPECT FOR LEAKS.		(17)	RELAYS; SWITCHES - INSPECT FOR CONTACT PITTING, ALIGNMENT, CORROSION, AND PRESENCE OF DIRT AND MOISTURE. SEE THAT MOUNTINGS AND CONNECTIONS ARE SECURE. PAR. 28i	
4	EXHAUST SYSTEM; GASKETED JOINTS - CHECK FOR LEAKS, GENERAL CONDITION		18	STARTING MOTOR - INSPECT COMMUTATOR, BRUSHES, MOUNTING. TEST OPERATION.	
5	COOLING SYSTEM - INSPECT GENERAL CONDITION. CLEAN-FLUSH LIQUID-COOLED SYSTEMS.		19	CHARGING GENERATOR - INSPECT COMMUTATOR, BRUSHES, MOUNTING. TEST OPERATION AND OUTPUT.	
(6)	CLEAN EXTERIOR OF EQUIPMENT. PAR 26c		20	BELTS - INSPECT FOR CONDITION, ADJUSTMENT, ALIGNMENT. CLEAN OFF OIL AND GREASE.	
7	FUEL STRAINER - CLEAN SEDIMENT BOWL AND SCREEN.		21	FUEL PUMP - INSPECT MOUNTING. CHECK FOR LEAKS. TEST OPERATION.	
8	GOVERNOR; THROTTLE - INSPECT MOUNTING; CONTROL LINKAGE FOR FREE MOVEMENT, WEAR, AND LUBRICATION.		22	VALVES - INSPECT VALVE MECHANISM FOR BROKEN SPRINGS, STICKING, TAPPET, CLEARANCE. ADJUST TAPPETS.	
9	FUEL TANK; CAP; GASKET - INSPECT TANK FOR LEAKS AND SECURITY; FILLER CAP CONDITION; GASKET CONDITION.		23	COMPRESSION - CRANK ENGINE BY HAND AND OBSERVE COMPRESSION.	
10	AIR CLEANER - DISASSEMBLE AND CLEAN. SERVICE OIL-BATH TYPE IN ACCORDANCE WITH LUBE ORDER.		(24)	COUPLINGS AND ALIGNMENT - CHECK SECURITY AND ALIGNMENT OF COUPLINGS. CHECK ALIGNMENT OF DRIVING AND DRIVEN COMPONENTS. PAR. 28j	
11	CRANKCASE; OIL FILTER - SERVICE CRANKCASE AND OIL FILTER IN ACCORDANCE WITH LUBE ORDER.		(25)	NUTS; BOLTS; SCREWS - TIGHTEN LOOSE NUTS, BOLTS, SCREWS AND OTHER FASTENINGS. PAR. 27c	
12	BATTERY - TEST ELECTROLYTE AND VOLTAGE. CHECK FOR LEAKS, CORRODED POSTS, LOOSE CONNECTIONS. INSPECT MOUNTING OR HANGER.		(26)	GENERATOR; EXCITER - CHECK BRUSHES, COMMUTATOR, SLIP RINGS, BRUSH SPRINGS AND MOUNTINGS. PAR. 28c	
(13)	WIRING - INSPECT EXPOSED WIRING FOR CUTS, FRAYING, CRACKS, AND LOOSE OR BROKEN CONNECTIONS. PAR. 27b		27	METERS; GAGES - INSPECT FOR CONDITION, BENT INDICATOR, HANDS, BROKEN GLASS, LOOSE MOUNTING AND CONNECTIONS, CORRECT ZERO ADJUSTMENT.	
14	MAGNETO OR DISTRIBUTOR - CLEAN EXTERIOR. INSPECT, CLEAN OR REPLACE AND ADJUST BREAKER POINTS.		28	FUEL; OIL; COOLANT - REPLENISH.	
	OPERATION TEST				
29	STARTING - CRANK ENGINE AND OBSERVE OPERATION OF STARTING MECHANISM. NOTE ANY DIFFICULTY IN STARTING.		35	MODIFICATIONS - SEE THAT REQUIRED MODIFICATIONS HAVE BEEN COMPLETED. CORRECT DIAGRAMS.	
30	OPERATION - OPERATE ENGINE AND NOTE ANY TENDENCY TO STALL OR MISFIRE. LISTEN FOR UNUSUAL NOISE. WATCH FOR OVERHEATED PARTS AND EXCESSIVE EXHAUST SMOKE.		(36)	ADJUSTMENTS - MAKE NECESSARY ADJUSTMENTS TO EQUIPMENT.	
31	GOVERNOR ACTION - APPLY AND REMOVE LOAD AND OBSERVE ACTION OF GOVERNOR. ADJUST IF NECESSARY.		(37)	FINISH - REMOVE RUST AND CORROSION; TOUCH UP OR REFINISH PAINTED SURFACES. PAR. 27d	
32	CLUTCH - ENGAGE AND DISENGAGE. CHECK FOR INDICATIONS OF GRABBING OR SLIPPING.		(38)	FUNGIPROOF - TREAT EQUIPMENT IN ACCORDANCE WITH CURRENT DIRECTIVES.	
33	CONTROLS; SWITCHES - CHECK OPERATION. SEE THAT METERS AND GAGES INDICATE CORRECTLY.		39	TOOL BOX; TOOLS - CLEAN TOOLS AND TOOL BOX THOROUGHLY. SEE THAT TOOLS ARE STOWED PROPERLY.	
(34)	GENERATOR - REMOVE PROTECTIVE COVERS AND CHECK FOR SPARKING BRUSHES. INSPECT SLIP RINGS AND COMMUTATOR. CHECK FOR HIGH, LOW OR FLUCTUATING VOLTAGE. PAR. 28c		40	FUEL; OIL; COOLANT - REPLENISH FUEL, OIL, AND COOLANT. PROTECT LIQUID COOLING SYSTEMS WITH ANTIFREEZE, WHEN NECESSARY.	
(41)	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 JAN 53 **11-261** REPLACES DA AGO FORM 11-261, 1 MAY 51, WHICH MAY BE USED

TM922-4

Figure 3. DA Form 11-260.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

POWER UNITS, REEL UNITS *(Engine-Driven)*
(SB 750-405-10)

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
(1)	BEFORE OPERATION INSPECT FOR TAMPERING AND/OR DAMAGE. PARS. 11b, 26a							
(2)	INSPECT FOR COMPLETENESS AND GENERAL CONDITION. INCLUDE TOOLS AND ACCESSORIES. PARS. 12, 26b							
3	FUEL AND LUBRICATING SYSTEMS - INSPECT FOR LEAKS.							
4	EXHAUST SYSTEM; GASKETED JOINTS - INSPECT FOR LEAKS.							
5	COOLING SYSTEM - INSPECT FOR LEAKS, CLEANLINESS, AND GENERAL CONDITION.							
(6)	CLEAN EXTERIOR OF EQUIPMENT. PAR. 26c							
7	FUEL FILTER - CHECK SEDIMENT BOWL FOR FOREIGN MATTER.							
8	AIR CLEANER; BREATHER - INSPECT FOR GENERAL CONDITION AND CLEANLINESS.							
9	SPARK PLUGS *(small units only)* - REMOVE, INSPECT, AND CLEAN.							
10	LUBRICATION - LUBRICATE IN ACCORDANCE WITH LUBRICATION ORDER.							
11	FUEL; OIL; WATER - REPLENISH AS NEEDED. ADD ANTIFREEZE IN LOW TEMPERATURES.							
(12)	DURING OPERATION PAR. 26e, f BE ALERT FOR UNUSUAL NOISE, VIBRATION, EXHAUST SMOKE, HEATING, MISFIRING, AND FAULTY OPERATION.							
(13)	AFTER OPERATION REPEAT BEFORE-OPERATION SERVICES. LEAVE EQUIPMENT READY TO OPERATE. PAR. 26a, b, c, g							
(14)	RECORD DAILY HOURS OF OPERATION.							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
15	BATTERY - INSPECT CONNECTIONS; LOOK FOR CORRODED POSTS, CRACKED CASES. TEST ELECTROLYTE. ADD WATER.		(23)	MAIN GENERATOR - INSPECT COMMUTATOR, SLIP RINGS, AND BRUSHES. PAR. 28c	
(16)	WIRING - INSPECT EXPOSED WIRING FOR CUTS, CRACKS, FRAYING, LOOSE TERMINALS, LOOSE OR DIRTY CONNECTIONS. PAR. 27b		24	METERS; GAGES - INSPECT CONDITION, MOUNTING CONNECTIONS. CHECK FOR CORRECT INDICATION.	
17	AIR CLEANER - INSPECT FOR DIRT OBSTRUCTIONS. IN OIL-BATH TYPE, CHECK OIL LEVEL AND CONDITION. SERVICE BREATHER.		25	LUBRICATION - LUBRICATE IN ACCORDANCE WITH LUBE ORDER.	
18	FUEL TANK; CAP - INSPECT TANK FOR LEAKS, SECURITY. BLOW THROUGH CAP VENT. INSPECT CAP GASKET.		(26)	FINISH - INSPECT PAINTED SURFACES. REMOVE RUST. TOUCH UP PAINTED SURFACES. PAR. 27d	
19	COUPLINGS; ALIGNMENT - CHECK COUPLINGS AND ALIGNMENT OF COMPONENTS.		27	FUEL; LUBRICANT; COOLANT - INSPECT FOR CONTAMINATION. REPLENISH.	
(20)	TIGHTEN ALL LOOSE NUTS, BOLTS, SCREWS, AND OTHER FASTENINGS. PAR. 27c		(28)	TEST - OPERATE EQUIPMENT AND OBSERVE OPERATION OF AUTOMATIC CONTROLS, GOVERNOR, SWITCHES, GAGES. PARS. 20, 21	
21	BELTS - INSPECT CONDITION, TENSION, ALIGNMENT.		29	ADJUST; REPAIR - MAKE ADJUSTMENTS AND REPAIRS AS AUTHORIZED.	
22	CARBURETOR - INSPECT MOUNTING AND LINKAGE. CHECK FOR LEAKS. CLEAN EXTERIOR.		(30)	RECORD TOTAL HOURS OPERATED DURING PERIOD COVERED BY THIS REPORT.	

(31) IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 JAN 53 **11-260** REPLACES DA AGO FORM 11-260, 1 MAY 51, WHICH MAY BE USED

TM922-3

Figure 4. DA Form 11-261

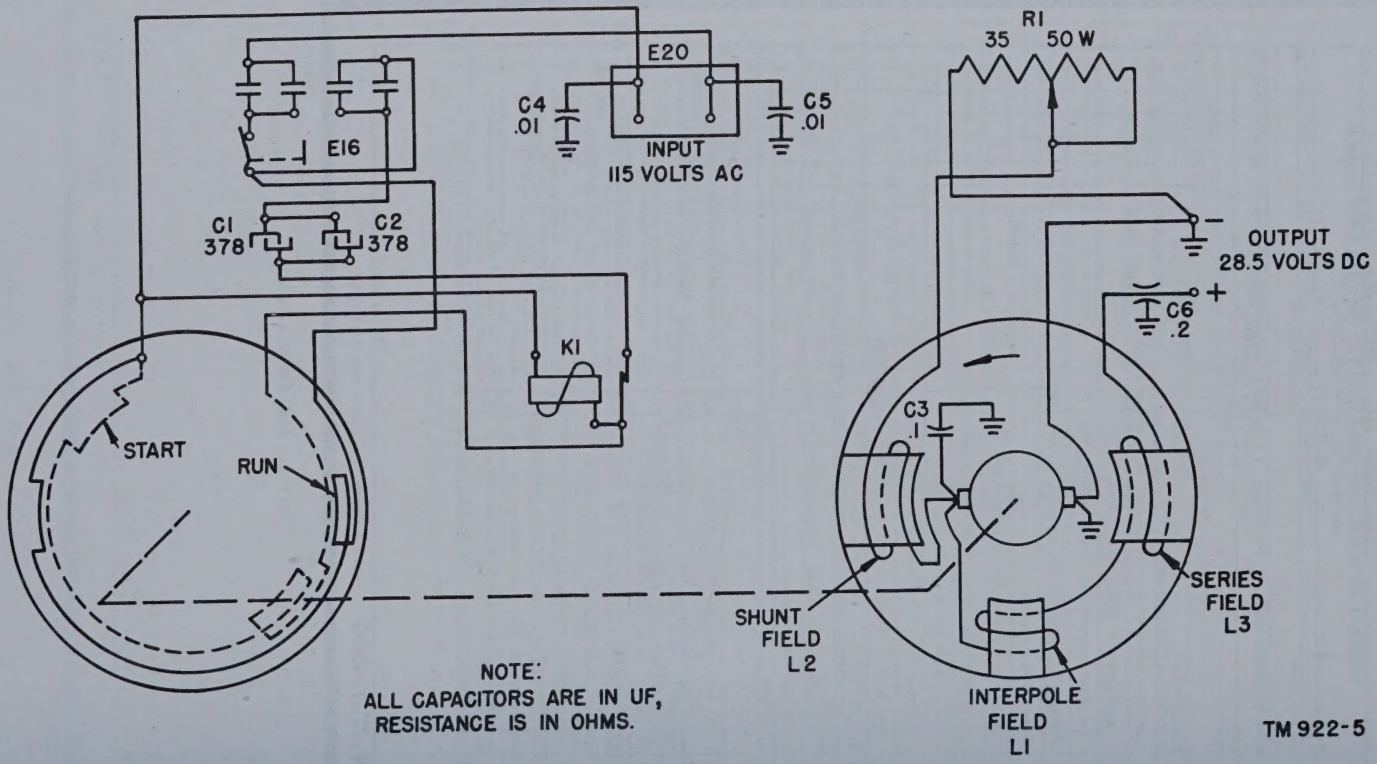

Figure 5. Motor-Generator PU-235/U, wiring diagram.

Section III. THEORY

30. General

Motor-Generator PU-235/U consists of a conventional ac motor driving a dc generator. The rotating components of the motor and the generator are mounted on a common shaft; the stationary components are housed in a common frame. When electrical energy is supplied to the ac motor, the motor converts it to mechanical energy. Because the two rotating parts of the unit are mounted on a common shaft, the mechanical energy of the motor rotor is directly transmitted to the armature of the generator. At this point the mechanical energy supplied by the motor is converted to dc electrical energy by the generator.

31. Motor

(fig. 5)

The motor of the PU-235/U is a conventional two-pole, single-phase, capacitor-start, squirrel-cage, induction-type, ac machine. In a single-phase machine of this type, there is no rotating field. The field merely pulsates and the rotor will not start to revolve. Therefore, the motor will not start itself unless the effect of a rotating field is provided and an inital impetus is given to the rotor. In this particular case, this is accomplished by using two separate windings and starting capacitors. The starting capacitors are connected in series with the starting winding. This causes a phase shift between the two windings, gives the effect of a rotating field, and causes the rotor to accelerate to its rated speed. When the rotor has reached approximaly 75 percent of its rated speed, the contacts of the starting relay open, the starting winding is disconnected, and the motor continues to run on the running winding. The combination of 60-cycle current and two-pole distribution gives an operating speed of approximately 3,590 rpm at no load.

32. Generator

(fig. 5)

a. General. The generator of the PU-235/U is a conventional two-pole, one-interpole, self-excited, compound-wound, dc type. It will deliver 52.6 amperes at 28.5 volts when operated at a speed of 3,500 rpm. Because only the interpole is unconventional, only this difference will be discussed here.

b. Interpole. At the instant each brush is contacting two segments on the commutator, a direct short circuit is produced. If an elecromagnetic force is generated at this time, a high current will flow in the short circuit. Excessive arcing will occur and the commutator will be burned. Ordinarily this is overcome by setting the brushes at the neutral plane. However, the current flowing in the armature coils sets up a field of its own that opposes the magnetic field of the field assembly. The presence of this opposing field causes the neutral plane to shift, and the more the load is increased the more the neutral plane will shift. Because it would be impractical to shift the brushes each time the load is varied, the interpole is used. This pole is placed between the two main poles and the winding on it is in series with the armature and connected so that it sets up a field of its own. This field opposes the field set up by the armature reaction and has a tendency to hold the neutral plane steady as the load varies.

Section IV. TROUBLE SHOOTING

33. Meaning of Trouble Shooting

The primary function of trouble shooting is to locate and correct the causes of faulty operation and equipment failure. All mechanical equipment is subject to occasional failure. Whenever difficulty with the equipment is experienced, the operator or the repairman must be able to locate the cause and correct it as quickly as possible. The trouble-shooting chart (par. 34) indicates various difficulties that are likely to be experienced, symptoms, that indicate that trouble exists, the possible cause, and the suggested remedy. Reference to various illustrations and diagrams in this instruction book will aid in localizing the seat of the trouble.

34. Trouble-Shooting Chart

a. Motor.

Symptom	Possible cause	Remedy
Failure to start.	Failure of power supply.	Check power supply.
	Loose connection.	Tighten all connections.
	Starting capacitor failure.	Replace starting capacitor (this type of failure is accompanied by a magnetic hum in motor).
	Power supply open.	Push STOP-RESET button, then push START button.
	Starting relay failure.	Replace starting relay.
	Motor Winding failure.	Replace entire unit.
Motor starts but does not reach rated speed.	Supply line voltage too low.	Change power supply.
	Failure of one starting capacitor.	Replace defective capacitor.
Excessive vibration.	Partial failure of motor winding.	Replace entire unit.
	Bearing failure.	Replace bearing.
Excessive heating.	Supply line voltage too low.	Change power supply.
	Restricted ventilation.	Remove restrictions from air flow.
	Excessive load on generator.	Remove overload.
	Rotor rubbing on stator.	Locate and remove cause of misalignment.
	Starting winding in circuit at all times.	Replace starting relay.

b. Generator.

Symptom	Possible cause	Remedy
Generator fails to produce rated voltage.	Speed is too low.	Change power supply.
	Loss of residual magnetism.	Flash field by momentarily touching F_1 to positive battery terminal and A_2 to negative battery terminal.
	Brushes not riding on commutator.	Check brushes on commutator.
	Loose connections.	Tighten all connections.
	Excessive film on commutator.	Clean commutator.
	Too much resistance in field circuit.	Turn rheostat to all out position.
Excessive arcing on commutator.	Brushes binding in brush holder.	Relieve binding by freeing brush in holder.
	Insufficient spring tension.	Increase spring tension.
	Overload on generator.	Remove overload.
	Brushes worn.	Replace brushes.
	Wrong brush.	Replace brushes with correct brushes.
	Commutator eccentric.	Restore concentricity.
	Excessive film on commutator.	Clean commutator.
Noisy operation.	Bearing worn.	Replace bearing.
	Parts rubbing.	Locate and remove cause of misalignment.
Overheating.	Overload on generator.	Remove overload.
	Restricted ventilation.	Locate and remove restrictions.
	Parts rubbing.	Locate and remove cause of misalignment.

CHAPTER 5

FIELD MAINTENANCE

Section I. REPAIR PROCEDURES

35. General

This chapter is written specifically for personnel in charge of field maintenance and repair. These instructions cover complete repair and overhaul of Motor-Generator PU-235/U. Instructions are included covering the procedure for disassembly, reassembly, adjustments and final testing before returning the unit to service. The extent of the repair to be performed is limited only by the tools and test equipment available and by the skill of assigned personnel.

36. Preliminary Inspection

Before starting any repair work, check the unit for indications of specific trouble noted by the operating personnel. If the unit is in operating condition, start it and check the appropriate items according to paragraphs 25 and 26. Inspection is completed only when this examination is finished and the proper Department of the Army form is filled out.

37. Power Source

To test this unit completely, a source of 60-cycle and 50-cycle ac power is required. The supply should be a minimum of 5 kilovolt-amperes (kva) continuous capacity and 10 kva overload capacity for 1 minute.

Section II. CLEANING AND STRIPPING

38. Cleaning

Remove all grease, oil, dust and dirt from the exterior of the unit. Use Solvent (SD) for cleaning if necessary.

Caution. Do not permit the solvent to touch any cables, wires, or electrical windings. Use compressed air to clean the interior of the unit and control box.

39. Stripping

The unit is designed so that the motor generator frame and control box need not be dismanteled for removal from the tubular frame. It is only necessary to remove the four nuts that fasten the motor generator frame to the vibration isolators (fig. 6). The set can now be removed through the end of the tubular frame.

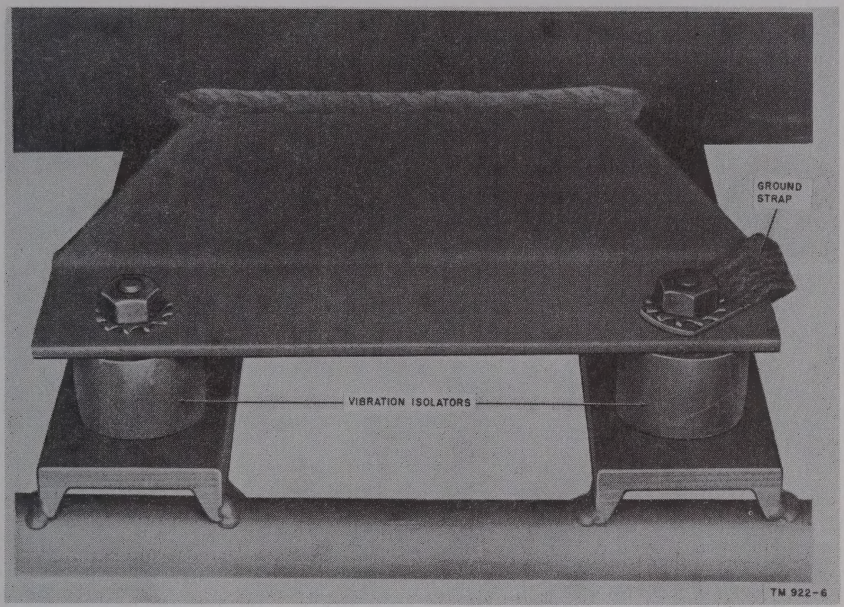

Figure 6. Vibration isolator assembly.

Section III. DISASSEMBLY, INSPECTION AND TESTING, AND REASSEMBLY

40. Disassembly

a. Control Box (fig. 7).

(1) Be sure the source of power has been turned off or disconnected, then open the door of the control box.
(2) Disconnect the two ac leads from the two bottom terminals of the terminal block; disconnect the two leads (4, 5) from the top terminals of the terminal block.
(3) Guide the two ac leads out of the control box.
(4) Remove the mounting screws that hold the terminal block to the control box and remove the terminal block.
(5) Disconnect the feed through capacitor lead (3) from the bottom of the capacitor.
(6) Disconnect the motor starter lead (10) from the starter.
(7) Disconnect the grounded output terminal wire (2) from the grounded output terminal.
(8) Disconnect the starting relay leads (11, 12) from the relay.
(9) Remove the two cap screws that hold the control box to the motor-generator frame.
(10) Disconnect the voltage adjusting rheostat lead (1) from the rheostat.
(11) Guide the wires that were disconnected through the hole in the back of the box and remove the box from the frame.
(12) Unsolder or disconnect all leads within the box.

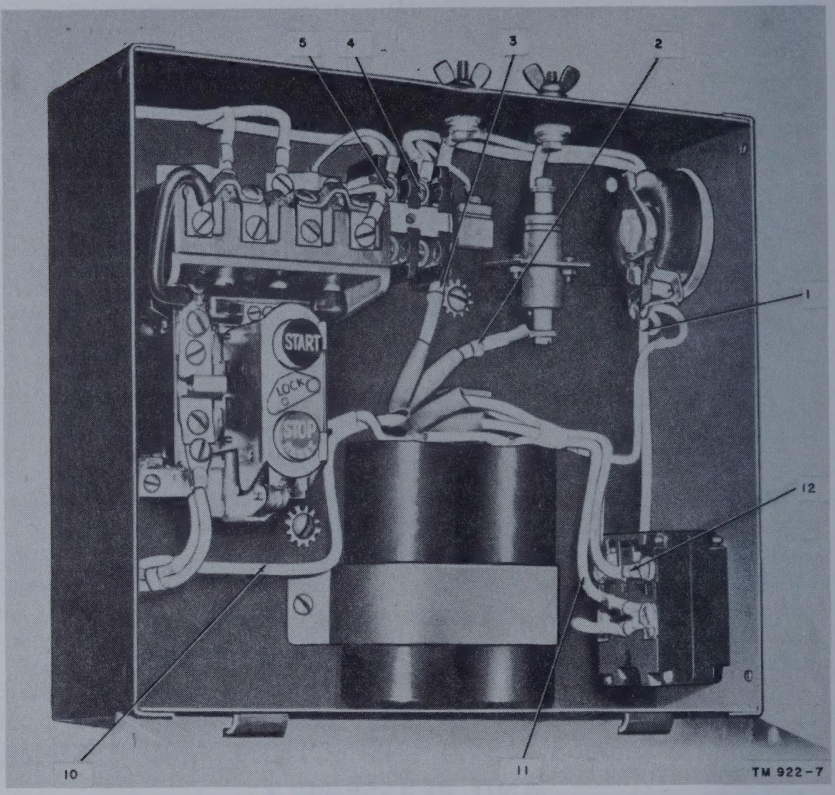

Figure 7. Control box wiring.

1. Voltage adjusting rheostat lead.
2. Feed through capacitor lead.
3. Grounded output terminal lead.
4. Terminal block to motor starting relay lead.
5. Terminal block to motor starter lead.
10. Motor starter lead.
11. Motor starting relay to capacitor lead.
12. Motor, to motor starting relay lead.

(13) Remove the set screw from the rheostat knob and remove the knob.

(14) Unscrew the lock nut that holds the rheostat to the control box and remove the rheostat from the inside of the box.

(15) Remove the three nuts that hold the motor starter mounting to the control box and remove the motor starter.

(16) Remove the two screws that hold the motor starting relay to the control box and remove the relay.

(17) Remove the capacitors by removing the screws that hold them to the control box.

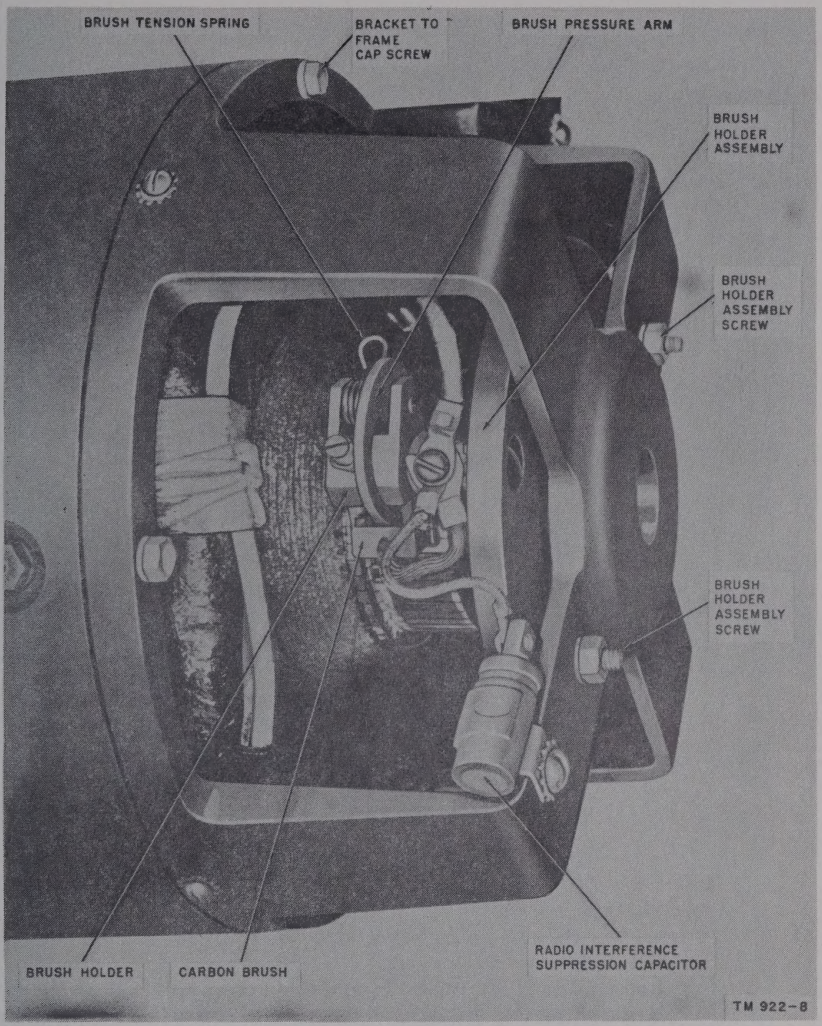

Figure 8. Generator end bell.

b. Generator End Bell (fig. 8).

(1) Remove the two screws that hold the end bell cover to the end bell and remove the cover.
(2) Remove the screw that holds the three leads to each of the two brush holders and remove the leads.
(3) Lift the brush arms and pull out the brushes.
(4) Remove the four cap screws that hold the end bell to the frame.
(5) Remove the end bell by tapping it with a rawhide mallet while pulling it away from the frame. It may be necessary at times to tap the end of the shaft to loosen the bearing in the end bell.

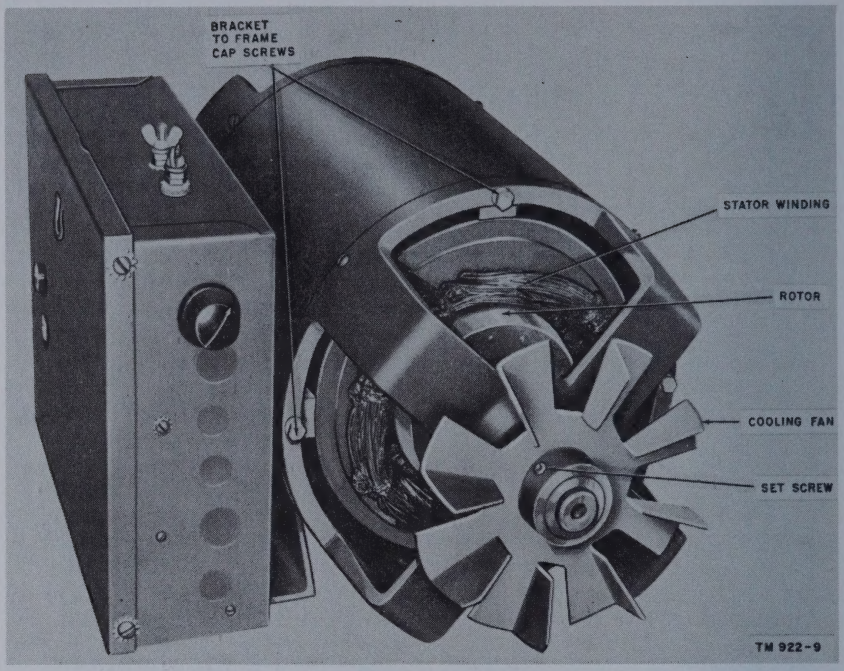

Figure 9. Motor end bell.

c. Motor End Bell (fig. 9).

(1) Loosen the two screws that hold the end bell cover to the end bell and remove the cover.
(2) Loosen the set screws in the cooling fan hub and remove the fan.
(3) Remove the four cap screws that hold the end bell to the frame.
(4) Remove the end bell by tapping it with a rawhide mallet while pulling it away from the frame. It may be necessary at times to support the generator end of the shaft and tap the motor end of the shaft to loosen the bearing in the end bell.

d. Motor Generator Frame and Armature (fig. 10 and 11).

(1) The armature may be removed from the frame by pulling it out of the generator end. Support the armature while it is being removed and be careful not to damage the windings or the commutator.
(2) Remove the two cap screws that hold each pole piece to the frame and remove the pole pieces.
(3) Pull the generator field assembly from the frame.
(4) Place the entire frame in an arbor press. Be sure that the press is not touching the windings, and press the motor stator from the frame.

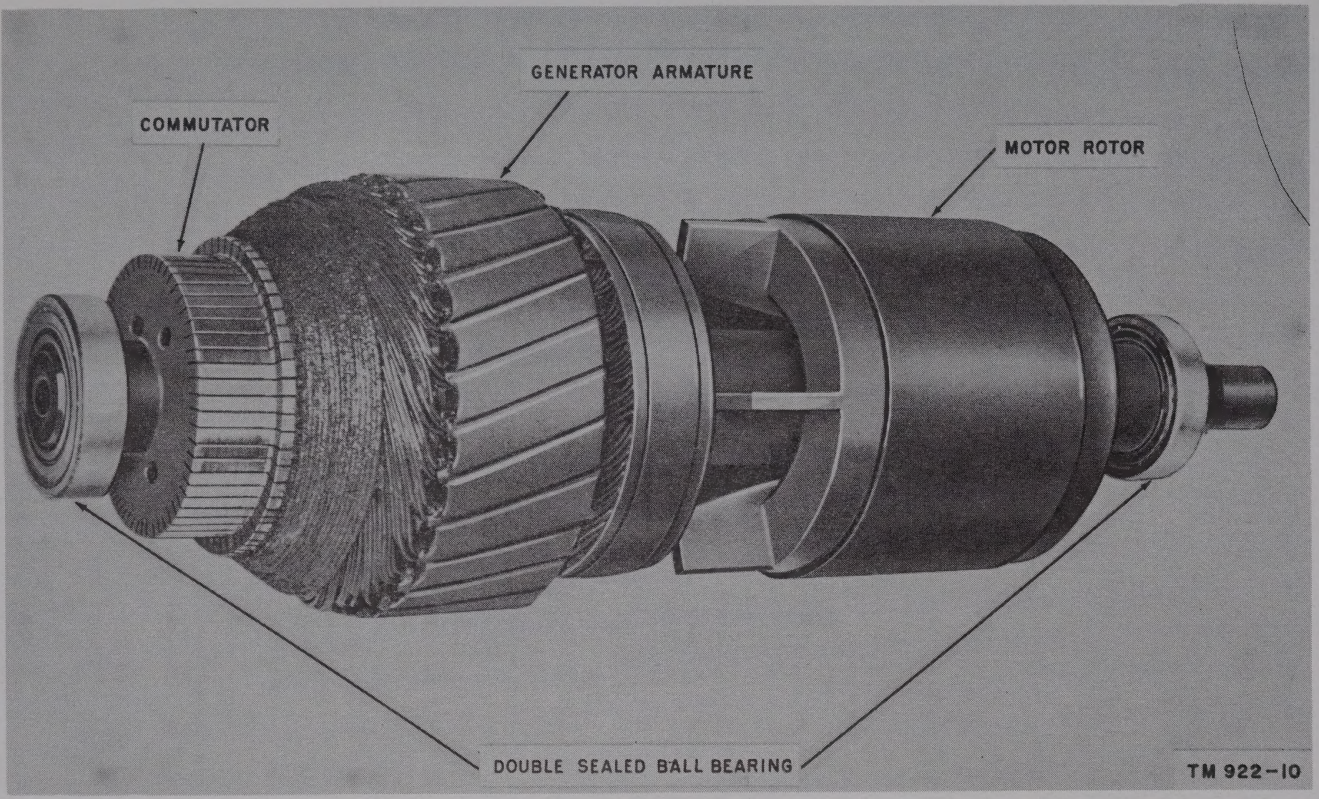

Figure 10. *Armature.*

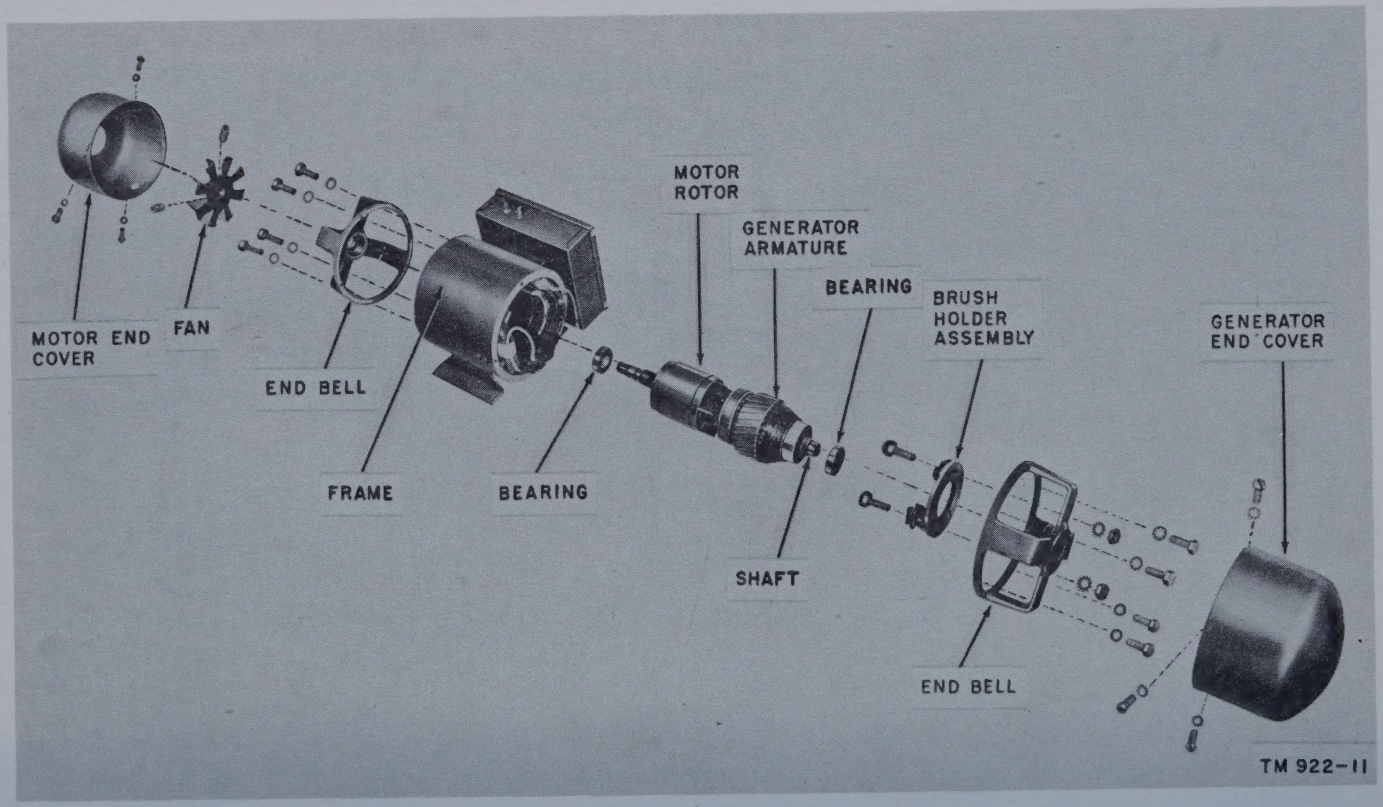

Figure 11. Motor-Generator PU-235/U, exploded view.

41. Inspecting and Testing

a. Control Box Components (fig. 2).

(1) Test feed through and filter capacitors for open or short circuits. Replace any that are defective.

(2) Check the motor starting capacitors for open and short circuits and for leaks. Replace any that are defective.

(3) Check the motor starting switch for pitted or burned contacts and general condition. Be sure the thermal overload element is in good condition and is of the correct value.

(4) Check the fixed and sliding contacts of the voltage adjusting rheostat. Be sure the rheostat is in good operating condition. Replace if defective.

(5) Check the motor starting relay for good operating condition. Replace the relay if defective.

(6) Check the insulation of the insulated output terminal and of all the wiring in the control box.

(7) Check the terminal block for cracks, corrosion, or short circuits.

b. Armature (fig. 10).

(1) Remove the bearings from the shaft with a bearing puller.

(2) Check the bearings for noise, worn condition, and dryness. If defective, new bearings must be installed before reassembly.

(3) Check the commutator for loose or burned bars and for loose connections where the ends of the armature coils are soldered to the commutator.

(4) Check the armature for open or short circuits and for grounds.

(5) If the commutator is burned, pitted, or uneven, restore it to a smooth, even surface by turning it in a lathe.

(6) If it was necessary to turn the commutator, undercut the mica between the bars and polish the commutator with fine sandpaper.

c. Frame (fig. 11).

(1) Check the generator field coil assembly and the motor stator for open or short circuits and grounds.

(2) Check the input leads of the motor and output leads of the generator for damaged insulation such as fraying, cracks, abrasion, and deterioration.

(3) Check the steel frame for cracks, distortion, and corrosion.

d. End Bells (fig. 11).

(1) Check the end bells for cracks, distortion, and corrosion.

(2) Check the bearing recesses for nicks, cracks, and excessive wear.

e. End Covers and Fan (fig. 11).

(1) Check the end covers for cracks, dents, corrosion, and distortion.

(2) Check the fan for distortion, cracks, and corrosion.

f. Brush Holder Assembly and Brushes (fig. 11).

(1) Be sure that the brush holders are secure on the ring.

(2) Check the brush pressure arm for freedom of movement.

(3) Check the brush spring for good condition and measure the amount of tension. It should be 12 ounces.

(4) Check the assembly for grounds.

(5) If any defects are noted, replace the entire assembly.

g. Tubular Skid Frame (fig. 1).

(1) Check all the welded joints for cracks and breaks.

(2) Check the entire frame for distortion.

(3) Check the vibration insulators for good condition. Replace them if worn or damaged.

42. Reassembly

(fig. 11)

Motor-Generator PU-235/U may be reassembled by reversing the procedures outlined in paragraph 40a through d. When reassembling the unit, observe the following cautions:

a. When replacing the cooling fan, be sure that the blades face away from the motor end bell.

b. Be sure that the armature shaft bearings are seated squarely against the shoulders on the shaft and not cocked.

c. Be sure that all leads are clear of rotating parts, are not pinched between the end bells and the frame, and are not grounding.

d. If the brush ring was removed from the generator end bell, be sure that it is replaced in the exact position. This is important to obtain proper commutation.

e. After the armature is in place and both end bells have been tightened securely, turn the armature by hand and be sure it rotates freely.

f. Check the end play of the armature. If there is more than 1/32 inch of movement, place shims between one bearing and its end bell. If shims are added, check the armature again for free rotation.

g. Before replacing the generator end cover, pass a strip of #0000 sandpaper (abrasive side out) between the commutator and the brushes. Move the sandpaper back and forth until the brushes are seated.

Section IV. ADJUSTMENTS AND FINAL TESTING

43. Adjustments

a. Motor Starting Relay (fig. 7). The starting relay contacts must open when a starting voltage of 135 volts ac is reached and they must remain open when the voltage drops back to 115 volts ac, which is the normal operating voltage of the motor. If an adjustment is necessary, the adjusting screw is located at the bottom of the starting relay, between the two halves. To lower the setting, turn the adjusting screw clockwise to raise the setting, turn the screw counterclockwise.

Note. Before the adjusting screw can be turned, the lower mounting screw of the starting relay must be loosened. This will unlock the adjusting screw. After an adjustment has been made, be sure to lock the adjusting screw by tightening the lower mounting of the relay.

b. Brush Holder Assembly (fig. 11). If excessive arcing is noted at the brushes, it is probably caused by improper commutation. Loosen the screws that attach the brush holder assembly to the end bell and rotate the assembly in either direction until the arcing stops. Under a heavy load, very fine (pin point) sparks may be noted and are permissible. After the adjustment has been made, be sure to tighten the screws that hold the brush assembly.

44. Final Testing

Follow the instructions in chapter 3, section II, for operation under usual conditions. See that the source of power is correct, then connect it to the unit. Start the unit without a load and operate it for about 10 or 15 minutes. Check the unit for unusal noises and vibration, and for any indications of a high temperature rise. It should be possible to place and hold the bare hand on the unit at all times. If the unit performs satisfactorily without a load, place a load upon it and watch it closely for another 10 or 15 minutes. Connect the proper meters to the unit and check the voltage and amperes. Compare the readings with the performance characteristics given in paragraph 6. Adjust the output voltage rheostat and observe the reading of the voltmeter to be sure that the rheostat is operating properly.

Section V. WEATHERPROOFING, REFINISHING, AND SUPPRESSION

45. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert areas, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, and TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment when operated in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment.

d. Desert Maintenance. Special precautions necessary to prevent failure of equipment when operated in areas of extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

46. Refinishing

a. If the painted surfaces of the unit are scratched or otherwise damaged, rust and corrosion can be prevented by repairing the damaged surfaces as quickly as possible. Motor-Generator PU-235/U is fungiproof and moistureproof at the time of manufacture, and should this processing be damaged at any time, it must be repaired (par. 45b).

b. Remove all oil, grease, and rust. Use solvent (SD) if necessary, for removing the oil, grease, and dirt. Use fine sandpaper for removing the rust. Apply two light, even coats of paint with a small brush. Two light coats of paint are better than one heavy coat. TM 9-2851 explains the proper procedures for refinishing equipment.

c. If extensive areas of the equipment require refinishing, remove all the old paint with paint remover. Sandpaper the surfaces clean and smooth. Apply a smooth, even, priming coat and allow it to dry. Sand lightly and apply the finish coats. Do not get paint on moving parts or electrical contacts.

47. Suppression

Motor-Generator PU-235/U has been suppressed to minimize radiation of undesirable radio-frequency (rf) waves by using internal-external toothed lock washers, a bonding strap, and feed through and filter capacitors. Failure to replace any of these suppression components will result in the loss of suppression characteristics. It is vitally important to replace each component in its exact original position when the equipment is being reassembled or parts are being replaced.

48. Suppression Components

The following components are used in suppressing Motor-Generator PU-235/U:

1 bonding strap.
Internal-external toothed lock washers.
1 feed through capacitor, 2.0 microfarad.
1 bypass capacitor, .1 microfarad.
2 bypass capacitors, .01 microfarad.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

49. Disassembly for Shipment or Limited Storage

The only disassembly necessary for Motor-Generator PU-235/U is disconnecting the unit from the power source and the load leads. Be sure that the power input leads have been disconnected, or shut off at the power source, then disconnect the input leads from the unit. Disconnect the load leads from the unit.

50. Preparation for Shipment or Limited Storage

a. Remove the covers from the generator and the motor end bells and blow out all dust, dirt, and brush residue with air pressure. Clean the covers and replace them.

b. Open the cover of the control box and blow out all dust and dirt with air pressure. Close the cover.

c. Clean and refinish the unit as instructed in paragraph 46.

d. Seal all openings with nonhygroscopic tape.

e. If the unit is to be moved only a short distance or stored for a short period of time, cover it with a tarpaulin.

f. If the unit is to be moved a considerable distance, prepare it for shipment by reversing the procedures of paragraph 11a.

Section II. DEMOLITION TO PREVENT ENEMY USE

51. General

The demolition procedures outlined in paragraph 52 will be used to prevent the enemy from using or salvaging the equipment. Demolition of the equipment will be accomplished only upon order of the commanding officer.

52. Methods of Destruction

When ordered by your commander, destroy all the equipment as follows:

a. Smash. Smash the skid frame, control box and its components, and the covers. Use sledges, axes, pickaxes, hammers, crowbars, and heavy tools.

b. Cut. Cut wires, cables, leads, armature windings, field windings, and stator windings. Use axes, handaxes, and machetes.

c. Explode. If explosives are necessary, use firearms, grenades, or TNT.

d. Burn. Burn all manuals, diagrams, documents, wire, windings, cables, cases, covers, and crates. Use gasoline, kerosene, oil, flame throwers, and incendiary grenades.

e. Disposal. Bury or scatter the destroyed parts in slit trenches, streams, fox holes, or other holes.

f. Destroy. Destroy everything.

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PARTS LIST

Pcs. Per Unit	K & R Part No.	Description	Supplier	Part No.
1	AA-1055M778	Armature	K & R	
2	15-944-73	Bearing, Ball	SKF	6206-2RS
2	19-946-94	Brush	K & R	
2	18-526-18	Brushholder	K & R	
2	71-1784-117	Brushholder Stud	K & R	
2	97-1280-36	Capacitor, Electrolytic	P. R. Mallory & Co.	CJ75A378DS
2	97-1280-33	Capacitor	Cornell-Dublier	MC976
1	97-1280-26	Capacitor	Tobe Deutschman Corp.	SIR9 CA442
1	97-1280-32	Capacitor	Cornell Dublier	NF-10270-1
1	63-947-150	Insulating Tubing, Output Terminal	K & R	
2	61-936-0	Insulator Washer, Output Terminal	K & R	
1	125-1951-15	Relay, Voltage	Cutler-Hammer	9575H1387A135
1	22-967-88	Rheostat, Shunt Field	Ohmite	0317
1	17-4405	Brushholder Ring	K & R	
1	132-2233-47	Rotor, Motor	K & R	
1	78-4535	Ground Lead	K & R	
1	125-4589	Bonding Strap	K & R	
1	125-4671	Starter, Manual Motor	Allen Bradley	609X0X
1	161-E1056	Motor Stator	K & R	
2	73-939-553	Terminal Stud	K & R	
1	12-E1055A	Coil, Generator Shunt Field	K & R	
1	14-E1055	Coil, Generator Interpole	K & R	
1	12-E1055B	Coil, Generator Series Field	K & R	
1	125-4671A	Thermal Release	Allen Bradley	Bul. 815 Type N43
4	125-4449	Shock Mounts	U. S. Rubber Co.	C-311